

Claims

1. An optical modulator comprising a Z-cut lithium niobate substrate on which is formed a Mach-Zehnder interferometer having two generally parallel waveguides lying beneath a buffer layer of dielectric material, and first and second ground electrodes and a hot electrode disposed on the buffer layer, the first and second ground electrodes being spaced either side of the hot electrode, the hot electrode and the first ground electrode being proximate to at least a part of the respective waveguides, characterized by an asymmetrical electrode structure in which
  - (a) the hot electrode and the first ground electrode each have a width substantially less than that of the second ground electrode
  - and/or*
  - (b) the spacing between the first ground and hot electrodes is different from the spacing between the second ground and hot electrodes.
2. An optical modulator according to claim 1 wherein the hot electrode and the first ground electrode have widths approximately equal to the widths of the waveguides beneath them.
3. An optical modulator according to claim 1 or claim 2 wherein the hot electrode and the first ground electrode have substantially equal widths.
4. An optical modulator according to any one of claims 1-3 wherein the hot electrode and the first ground electrode each have a width less than that of the second ground electrode and not exceeding  $15\mu\text{m}$ .
5. An optical modulator according to claim 4 in which the spacing between the first ground and hot electrodes is smaller than the spacing between the second ground and hot electrodes.
6. An optical modulator according to any one of claims 1-4 wherein the second ground electrode has a width at least five times greater than that of the hot electrode.
7. An optical modulator according to any one of claims 1-4 wherein the second ground electrode has a width at least ten times greater than that of the hot electrode.
8. An optical modulator according to any one of claims 1-6, wherein the spacing between the first ground and hot electrodes is between  $10$  and  $30\mu\text{m}$  and the spacing between the second ground and hot electrodes is greater and between  $20$  and  $80\mu\text{m}$ .
9. An optical modulator according to any preceding claim, wherein the dielectric material comprises silicon dioxide with a thickness between  $0.4$  and  $1.5\mu\text{m}$ .

10. An optical modulator according to any preceding claim, wherein the electrodes comprise gold having a thickness between 15 and 50 $\mu$ m.